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FISHERIES

**West Coast
Region**

Endangered Southern Resident Killer Whales

10 Years of Research and Recovery

Lynne Barre




Killer Whales

- The most widely distributed mammal (other than humans)
- Abundant in coastal waters and high latitudes


Orcinus orca KILLER WHALES *Ecotypes & Forms*

A diversified portfolio


SOUTHERN HEMISPHERE

- Antarctic Type A Killer Whale**



A large (perhaps to 9.5 m (31 ft)), black and white form. It migrates to Antarctica during the austral (southern) summer where it forages in open (ice free) waters and feeds mainly on minke whales and occasionally elephant seals. During the winter, it probably migrates to lower latitudes, perhaps to the tropics.

males - females
 some have slight open saddle
 often has yellow cast due to diet items
- Pack Ice Killer Whale (large type B)**



A large, two-toned gray and white form with dark cape pattern and very large eye patch. Often has yellowish cast due to diet items. Circumpolar, it forages mainly in loose pack ice where it preys on ice seals (prefers Weddell seals), which groups wave-wash off ice floes by creating waves with their tails; occasionally takes minke whales.

large oval eye patch
 dorsal cape sometimes shows narrow white border
 shown without diet items
- Gerlache Killer Whale (small type B)**


A medium-sized, two-toned gray and white form with a dark eye patch pattern and large white eye patch. Often appears yellowish due to diet items. Common around Antarctic Peninsula, especially in the Gerlache Strait. Preferred prey unknown but has been seen feeding on penguins on numerous occasions.

often has yellow cast due to diet items
 dorsal cape sometimes shows narrow white border
 large oval eye patch, narrower than Pack Ice Killer Whale
 some have slight open saddle
 shown without diet items
- Ross Sea Killer Whale (type C)**



The smallest killer whale known - adult males reach only 6 m (20 ft). A two-toned gray and white form with a dark gray cape often colored yellowish by diatom film. Eye patch is distinctly narrow and slanted. Occurs deep in the pack ice in eastern Antarctica and feeds on fish, especially common in the Ross Sea.


often has yellow cast due to diet items
 narrow forward-slanted eye patch
 dorsal cape
 shown without diet items
- Subantarctic Killer Whale (type D)**



Recently described form, known from perhaps a dozen sightings. Easily recognized by its tiny eye patch (all ages); head is rounded, dorsal fin often swept back and pointy. Distribution circum-global in subantarctic waters (north of 40°S); sometimes associated with islands. Preferred prey unknown but reportedly steals fish off long lines.


dorsal fin swept back
 tiny eye patch
 bulbous forehead
 faint saddle


NORTHERN HEMISPHERE

- Resident Killer Whale**







males - females
 tall dorsal fin may be forward-slanted, with wavy trailing edge
 dorsal fin rounded on top with pointed trailing tip
 often has very open saddle
- Bigg's Killer Whale (transient)**


males - females
 generally pointed dorsal fin
 eye patch usually slants slightly downward towards the rear
 closed saddle, often extends past midline of dorsal fin
- Offshore Killer Whale**


males - females
 faint saddle
 dorsal fin rounded at tip
 often have nicks in dorsal fin
- Type 1 Eastern North Atlantic**


males - females
 conspicuous saddle
 relatively large eye patch
 some teeth produce white rake marks
- Type 2 Eastern North Atlantic**


males - females
 eye patch often slants toward rear
 faint saddle

- The best-known killer whale. A medium-large (to 7.3 m), black and white form that lives in coastal waters of the North Pacific. Saddle patch often has a large black intrusion ('open' saddle) not found in other killer whales. A fish-specialist - some populations feed almost exclusively on salmon. Females may live to 80-90 years.**

- A large (perhaps 8 m), black and white form - similar to resident killer whale except it lacks an open saddle. Occurs in coastal and offshore waters of the North Pacific. A mammal-eater, it feeds mostly on harbor seals and minke whales but will also take sea lions, otters, calves of large whales, etc. Named after pioneer killer whale researcher - Michael Bigg.**

- A smaller form (to 6.7 m) rarely observed because it occurs mainly over outer continental shelf of eastern North Pacific. Group size usually large (100-200); ranges widely; some groups travel between Alaska and southern California. Apparently feeds extensively on sharks and tooth are often worn to gum line due to rough skin of sharks.**

- A smaller (to 6.6 m), black and white form, currently known only from the North Atlantic. Off Norway, feeds on herring and mackerel, which are cooperatively herded into dense schools; some individuals have also been seen to take seals. Teeth of this form are often worn smooth to the gum line - perhaps from feeding on sharks also.**

- A large (to 8.5 m), black and white form (only recently recognized), but with a distinctive back-dipping white eye patch. Few rounded observations, but currently known only from the North Atlantic where it is known to prey on other cetaceans, especially minke whales.**


0 10 m (32.8 ft)

The killer whale (*Orcinus orca*) occurs in all the world's oceans where it is the top marine predator and perhaps the most widespread vertebrate on earth. Although currently considered to be a single, worldwide species, recent research has revealed that there are at least 10 recognizable forms (or ecotypes) of killer whales, which are shown here drawn to scale. For the most part, these forms have different prey preferences, distributions, social structures, foraging behaviors, acoustics, physical features, and genetics. This has led some researchers to suggest that there is more than one species of killer whale, and perhaps several. Our research seeks to understand the taxonomy and role of these predators in marine ecosystems.
<http://owfsc.noaa.gov/prd-killerwhale/>

Illustration and design: Udo Gorter (www.ugorter.com) Text: R. L. Pitman, Southwest Fisheries Science Center, NOAA Fisheries Service, Robert.Pitman@noaa.gov Photo credits: R.L. Pitman (1,2,4,7), John Durban (3,6), Paul Tixier (5), Paul Wade (8), Andy Poole (9), Lewis Drysdale (10)

Pacific Northwest Ecotypes

- Transients
 - Marine mammal eaters
 - Small groups
- Offshores
 - Limited information
 - Eat fish, sharks (?)
 - Large groups
- Residents

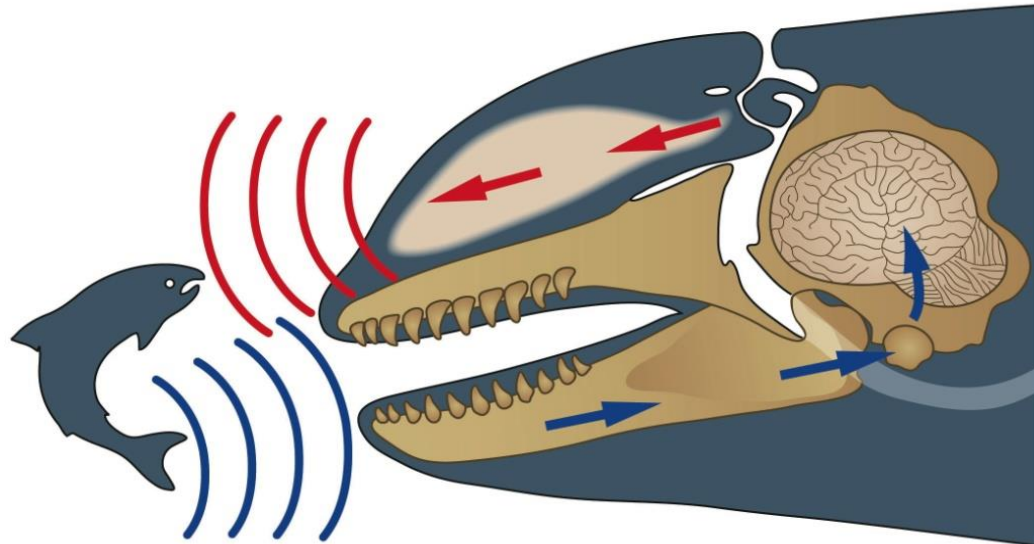


Photo by Robin Baird

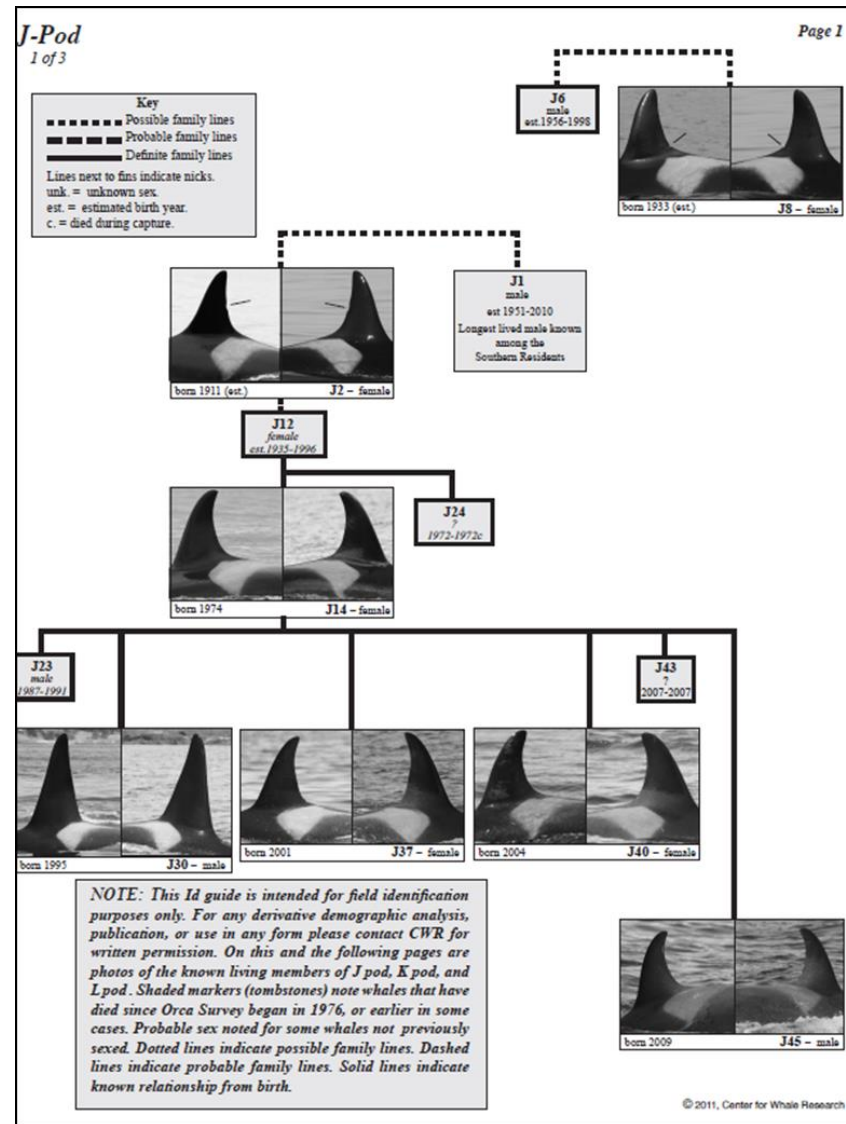


Southern Resident Killer Whales

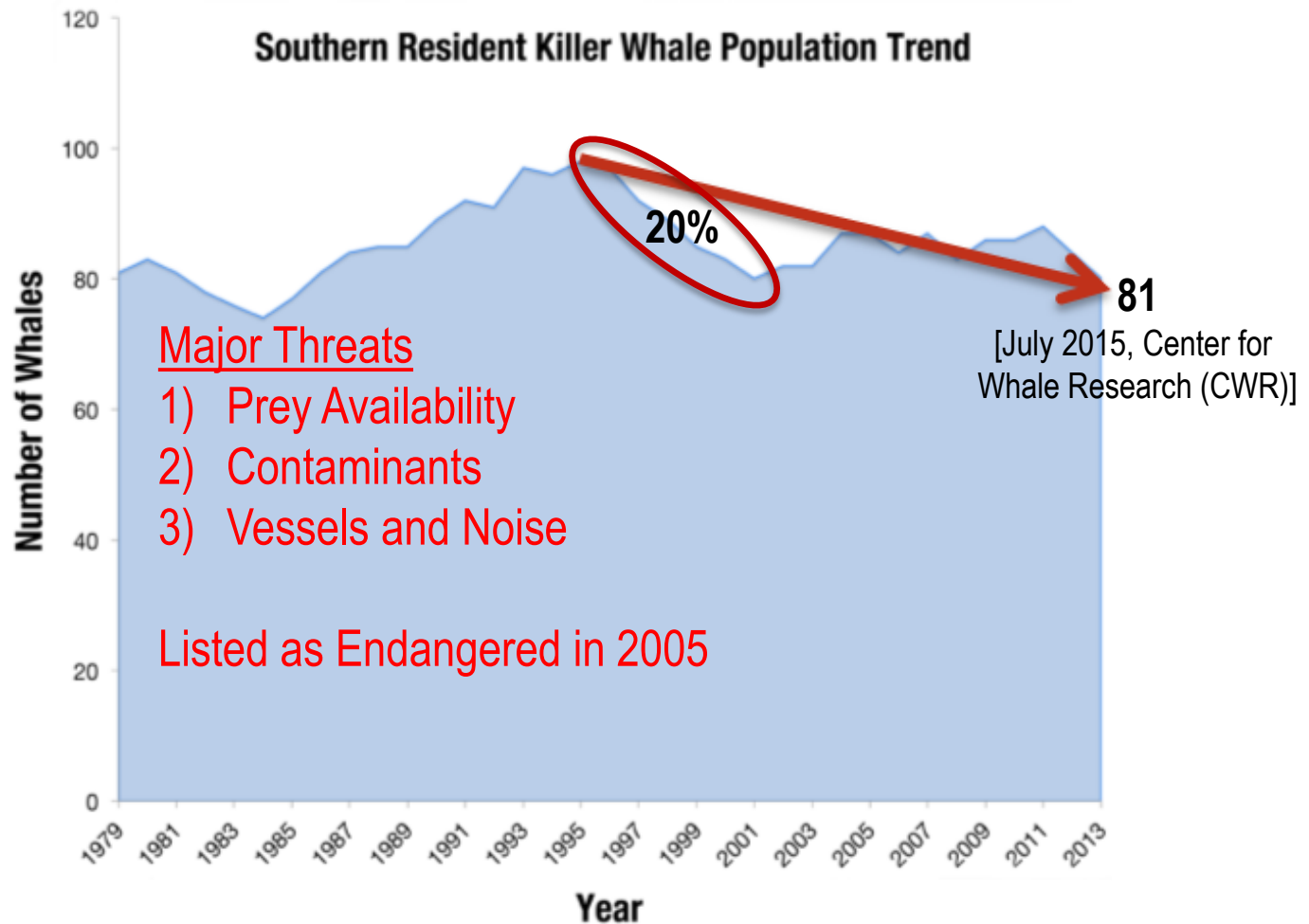
- Stable family groups
- Salmon prey (Chinook)
- Use sound to find food and communicate
- Distinct dialects
- Unique behaviors



Southern Resident Killer Whales

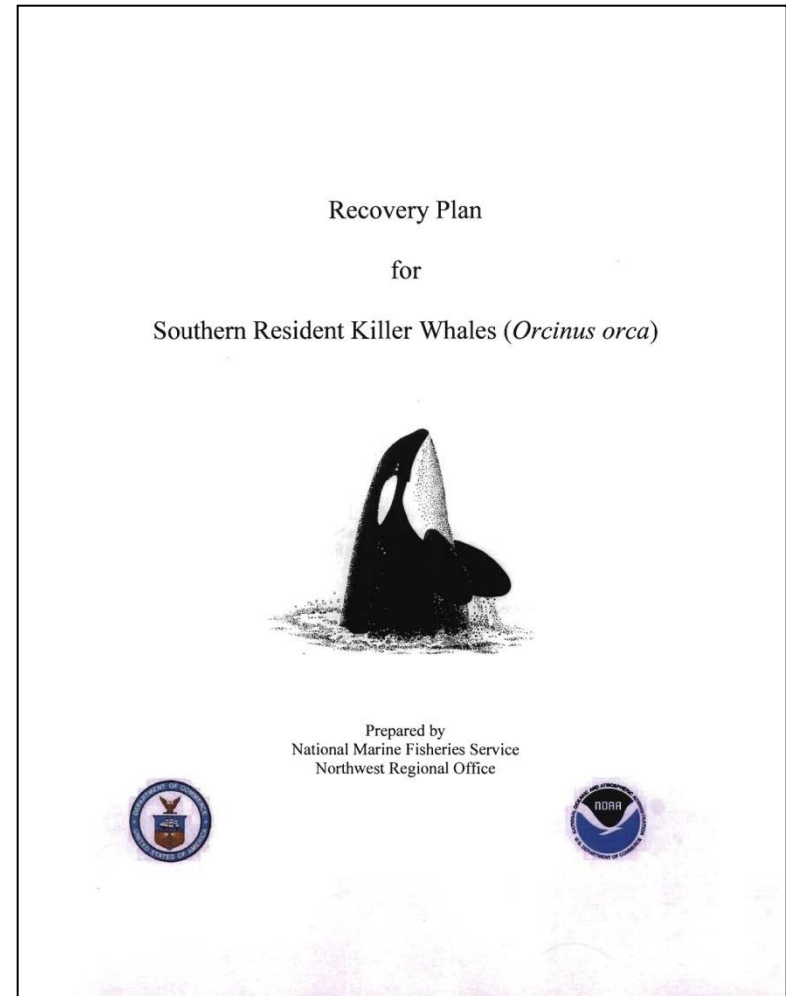


Southern Resident Decline and Risks

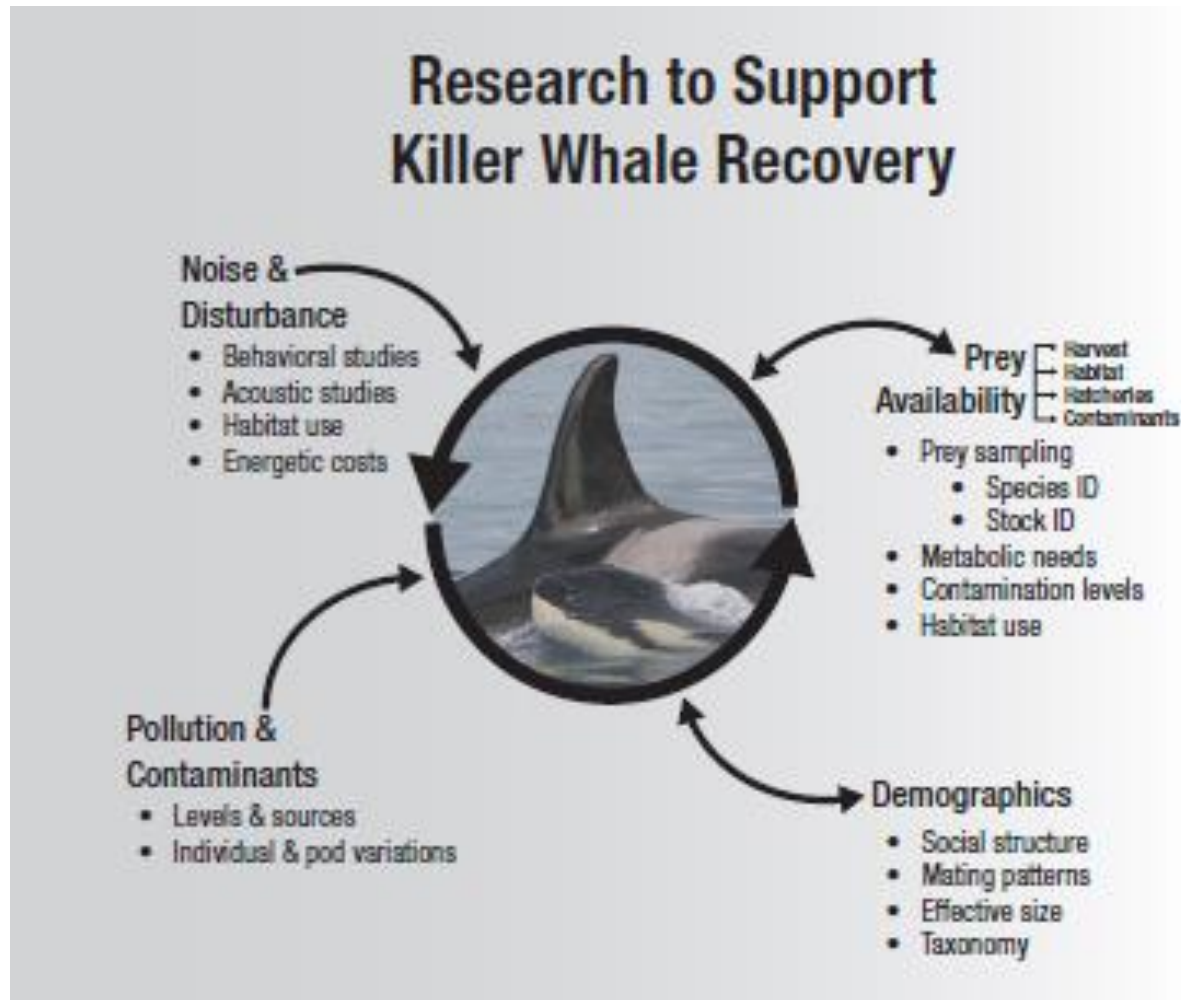


Recovery Plan

- Started implementing actions in 2003 with specific funding
 - Research
 - Enforcement support
 - Education
- Recovery Plan complete 2008
- Broad approach to address all threats
- Adaptive process to incorporate research results as available



Ongoing and Future Research



Prey Availability



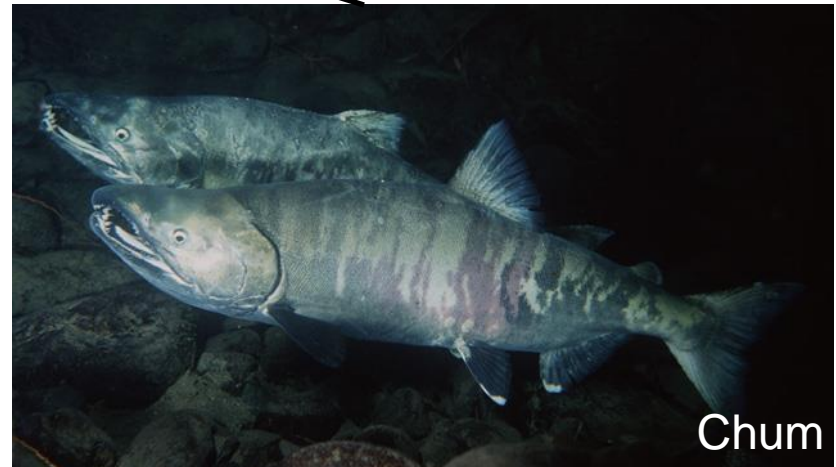
Photo: CWR



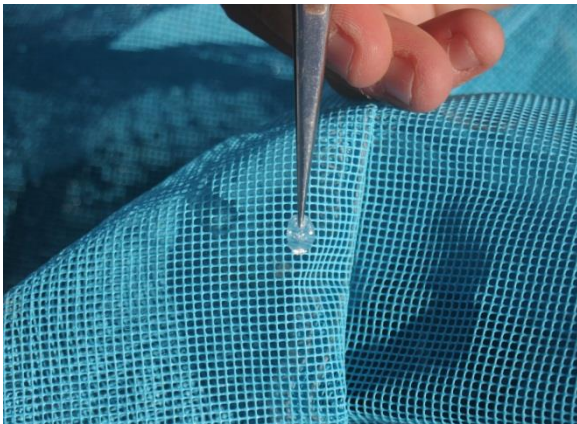
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Prey

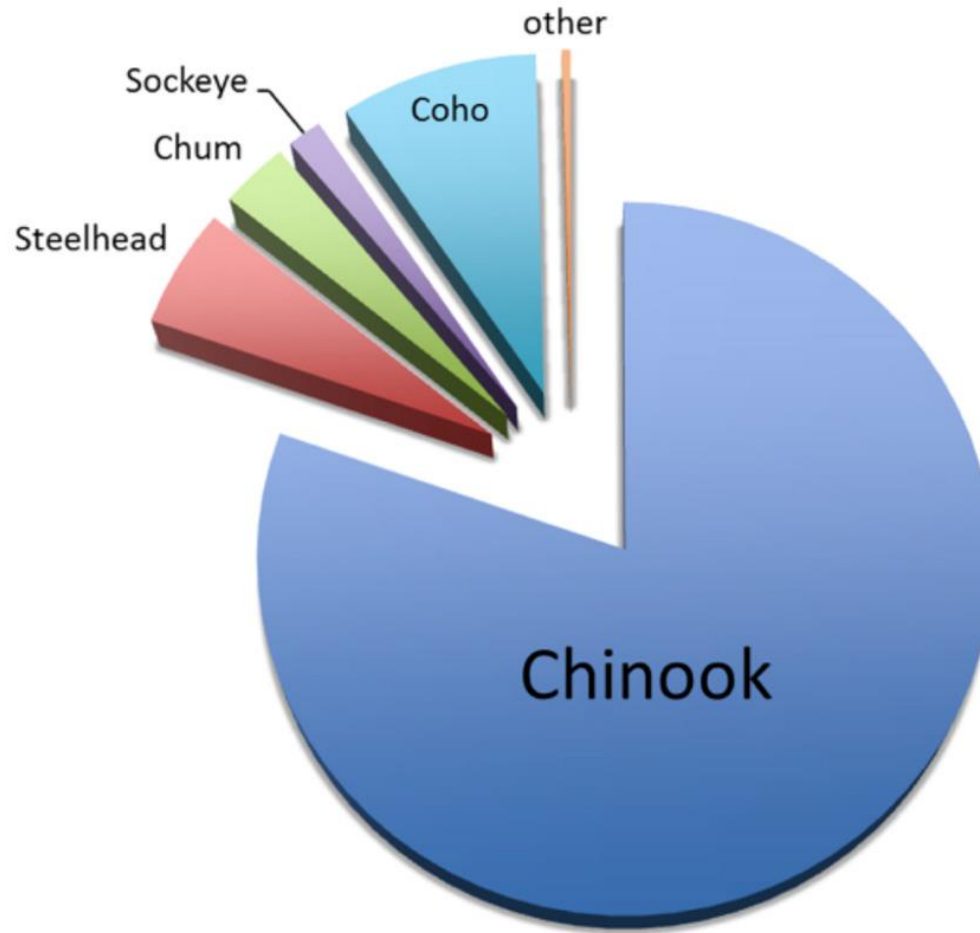
Are there enough fish for the whales?



Prey Selection Field Methods



Composition of the Southern Residents' Summer Diet



Scale and tissue samples from prey collected in Southern Residents' summer range (includes the Western Juan de Fuca Strait and San Juan Island) from May to September 2004-2008. More than 75% of the whales' summer diet is Chinook. Selection varies somewhat by month. From Hanson et al. 2010.



Prey

- Coordinating with ongoing salmon recovery efforts
- Review of salmon fisheries and Southern Resident killer whales



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Puget Sound Salmon Recovery Plan



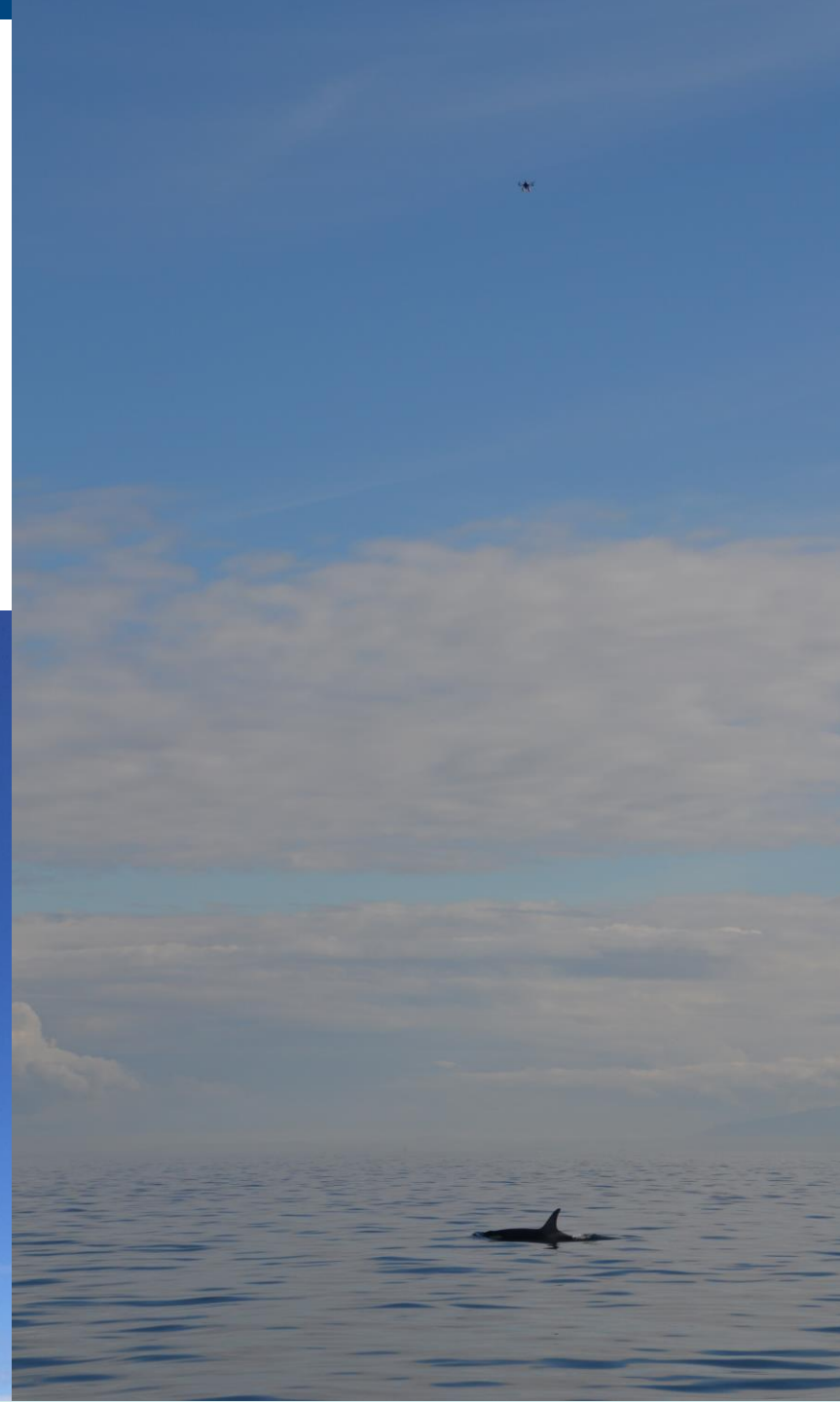
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Photogrammetry

- Where and when are the whales food limited? How can we prioritize salmon recovery to benefit the whales?

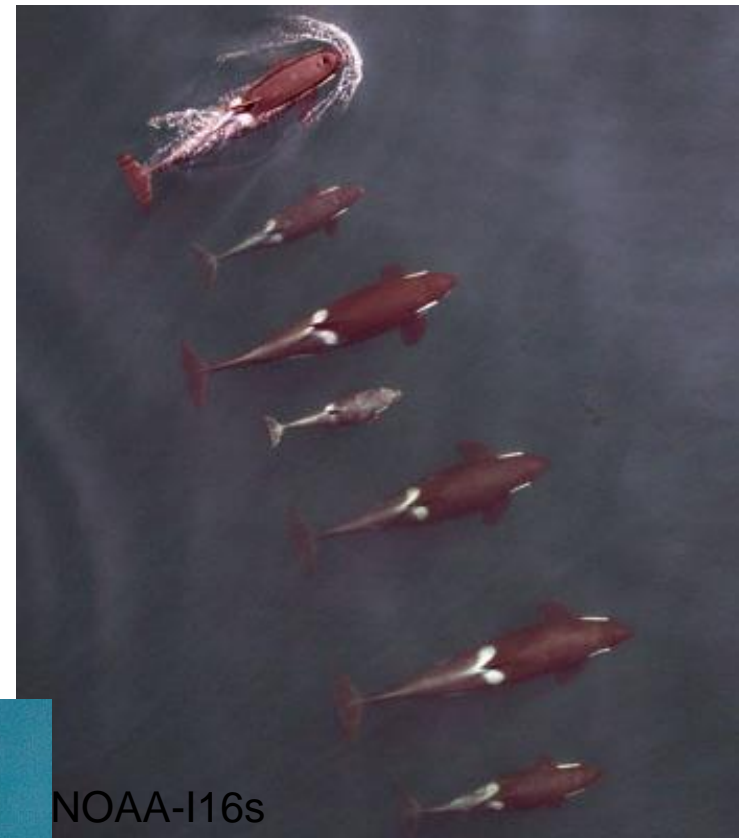


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Photogrammetry

- Measuring aerial photos to understand health and reproduction
- Compare Northern Residents and Southern Residents



Contaminants



Pollution and Contaminants

Killer whales are at the top of the food chain

- Bioaccumulation of contaminants (PCBs, DDTs, PBDEs)
- High levels can cause reproductive and immune problems



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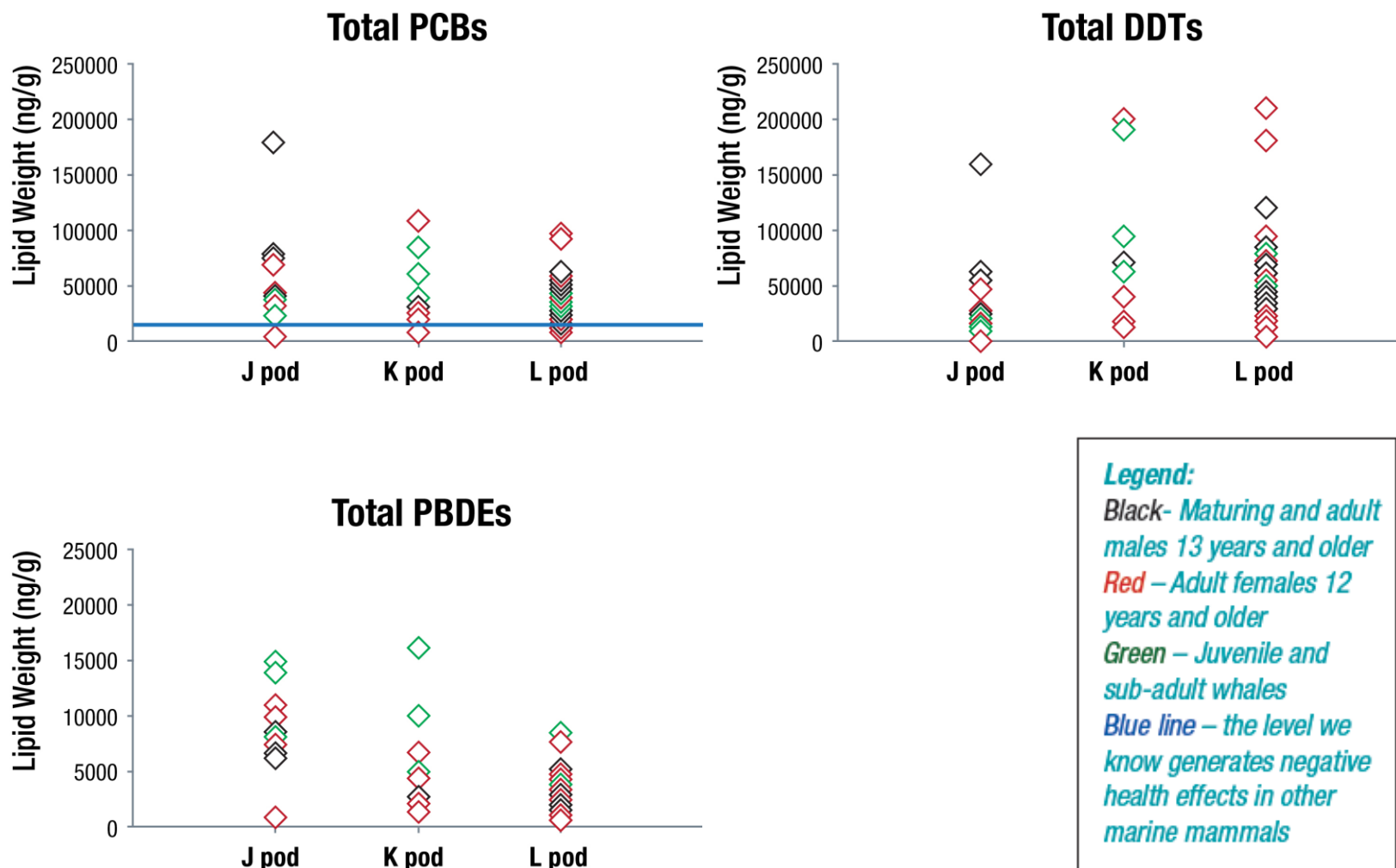
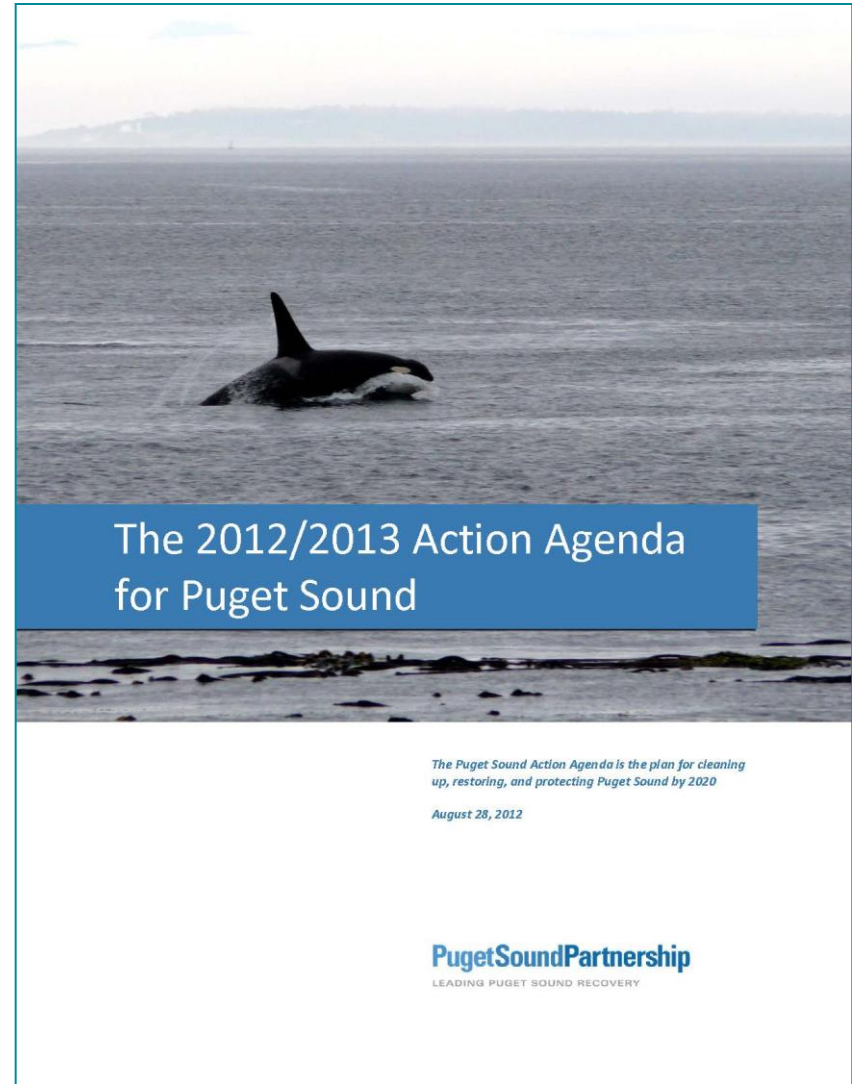


Figure generated from Krahn et al. 2007, 2009 and NWFSC unpublished data.

Contaminants

Puget Sound Partnership

- Action Agenda to restore Puget Sound by 2020
- Working group with EPA and WA state agencies



Vessels and Noise



Vessels and Noise

Killer whales use echolocation to find food and use sound to communicate and navigate

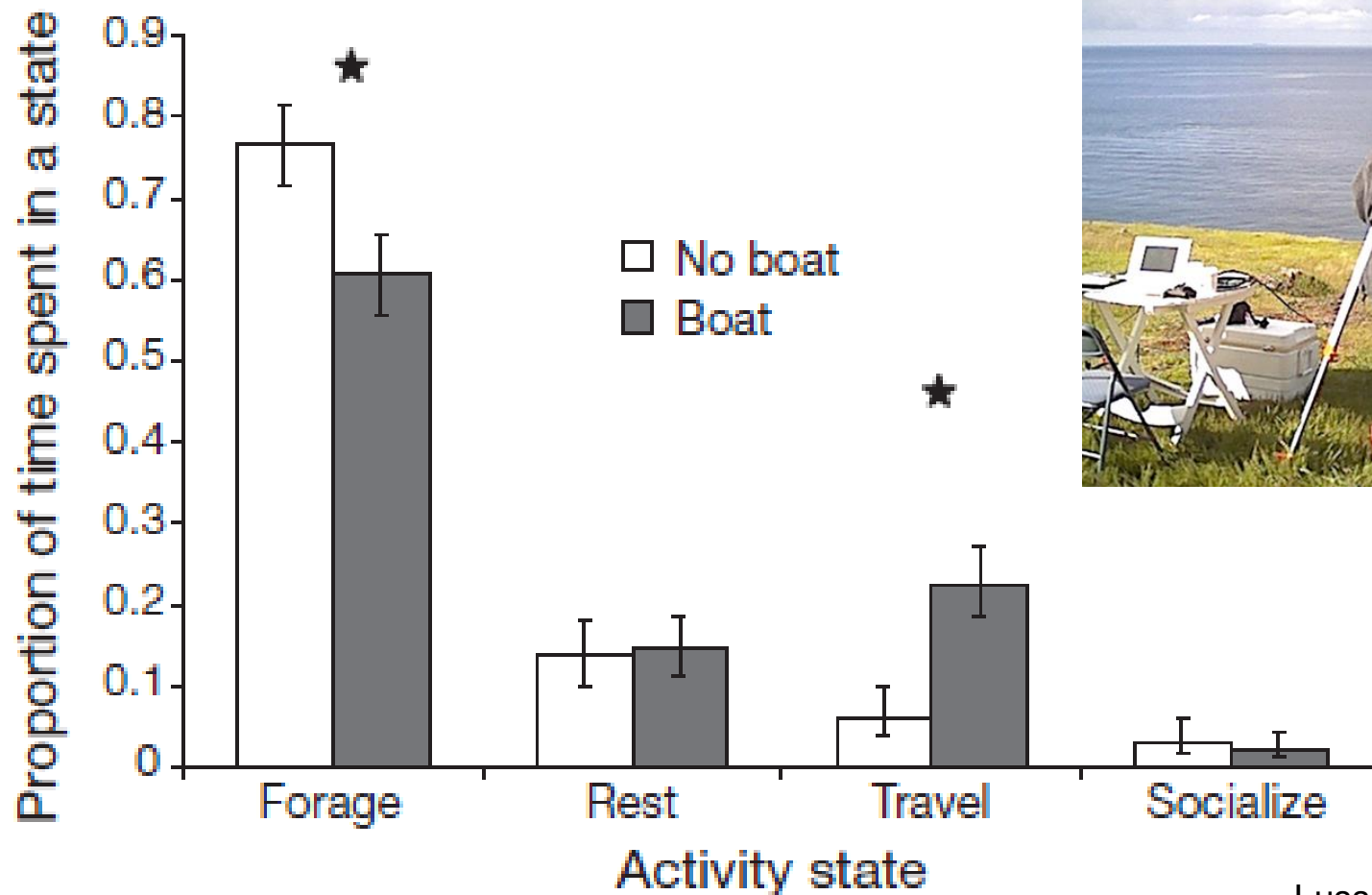


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Foraging is reduced and travel is increased when vessels are present within 400 m



Lusseau *et al.* 2009

Killer whales increase surface active behaviors in the presence of vessels

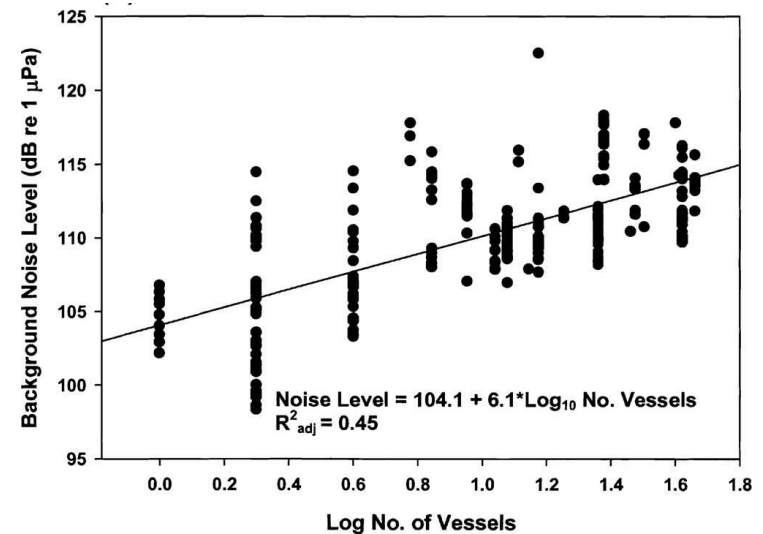
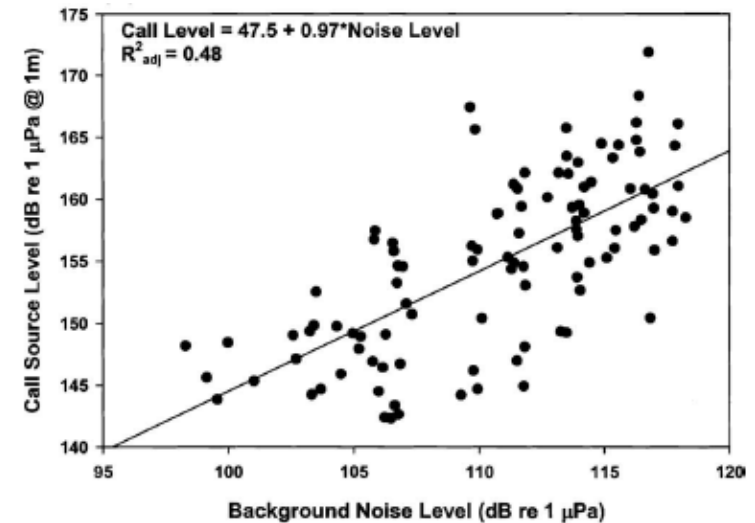


Surface active behavior bouts \uparrow when vessel distance to whale \downarrow
Surface active behavior bouts \uparrow near the time of the closest vessel approach

Noren *et al.* 2009

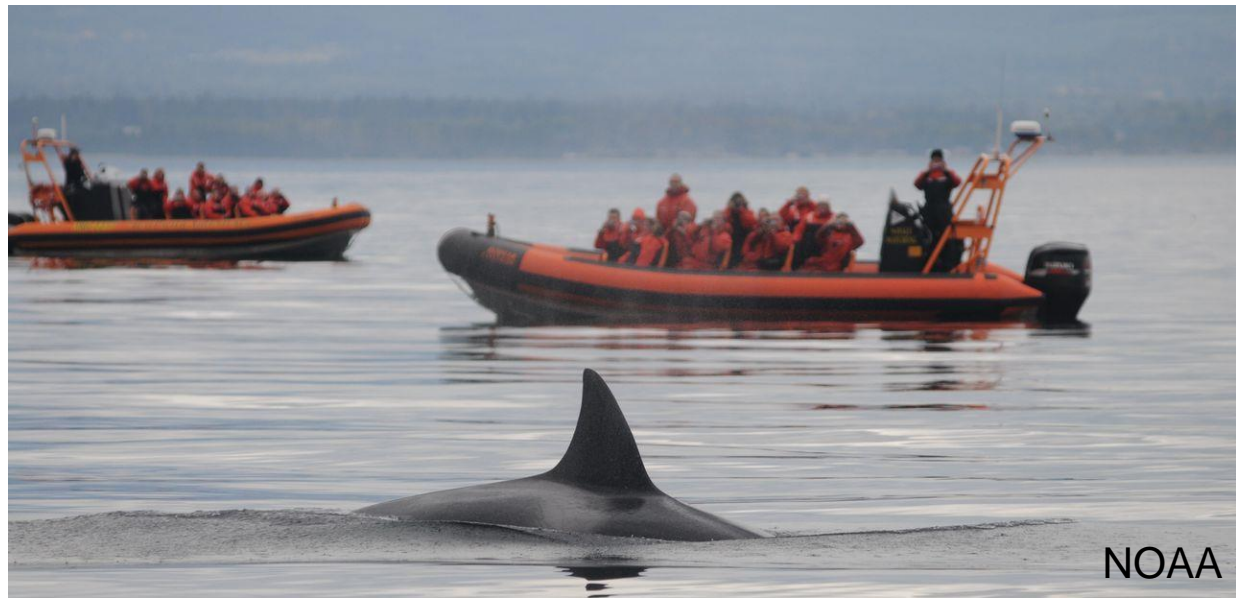
Killer whales modify calls in response to background noise levels

- SRKW call source levels increase with increasing ambient noise
- Background noise increases with number of boats



Holt et al. 2009

Protective Regulations



The final regulations make it unlawful for vessel operators to:

1. Cause a vessel to approach, in any manner, within 200 yards of any killer whale.
2. Position a vessel to be in the path of any killer whale at any point located within 400 yards of the whale.

Implementation of New Regulations

Education and Outreach

- Continue working with partners- Soundwatch, Straitwatch, WDFW, DFO
- Update Be Whale Wise


Enforcement

- Joint Enforcement Agreement with WDFW, ESA grant

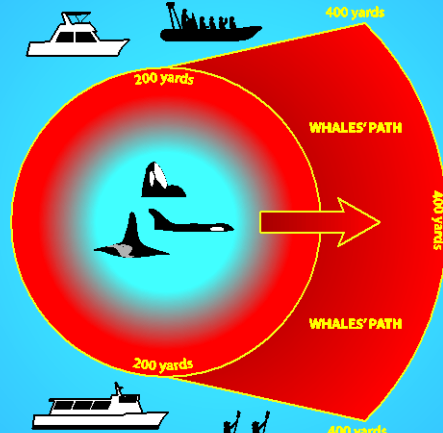
Monitoring

- Collect data on vessel activity/compliance
- Collect data on economic impacts




Be Whale Wise
and follow the Law
It's as easy as 1, 2, 3...



1. The **ONE** place not to be is in the path of whales. Don't position your vessel in the path of oncoming whales within 400 Yards of a whale.
2. **Sta** at least **TWO** hundred Yards away from an/ killer whale (200 Yards = the distance of two football fields and is about 200 meters).
3. Remember these **THREE** wa's to Be Whale Wise: follow the guidelines for viewing all wildlife, check for local protected areas and restrictions, and alway's be safe.



Visit www.bewhalewise.org to learn more, download the laws, regulations, and guidelines, and to report violations.



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Other Risk Factors

Social structure and distribution make the Southern Residents vulnerable to

- Oil spills
- Disease



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Oil Spill Response Plan

- Action in Recovery Plan and Recovery Criteria
- Draft Response Plan-Appendix to the Northwest Area Contingency Plan
- Spill drill March 2013, San Juan Islands with IOSA and WDFW



Strandings

- Increase reporting
- Conduct full exams and necropsies
- Determine cause of death
 - Disease
 - Human interaction
 - Natural causes

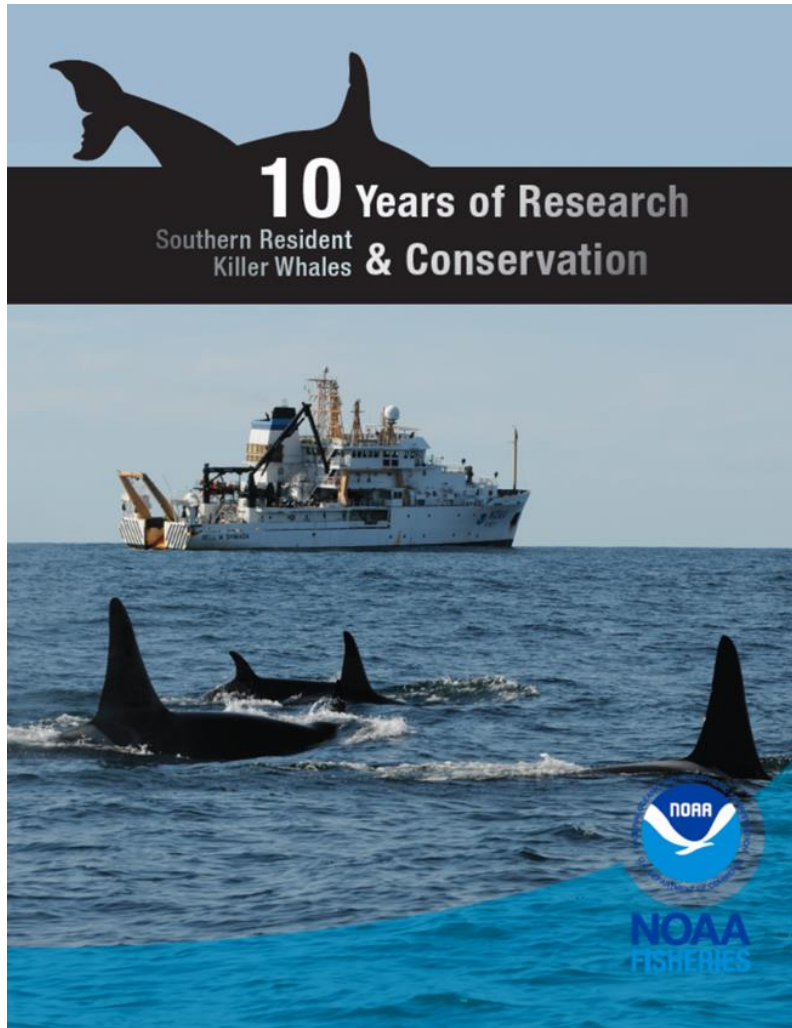


ESA Section 7 Consultations

- Fisheries regulations
- Hydropower actions (including hatchery production)
- Water treatment plants, sewer outfalls
- In-water construction
 - Pile driving sound, increase in vessels (docks, marinas), dredging (contaminated sediments)
- Upland projects (Flood Insurance Program)
- Habitat restoration (creosote pile removal)
- Research on Southern Resident killer whales
- Tidal and wave energy projects, LNG terminals
- Navy and Coast Guard operations



The Next 10 Years



- Winter distribution and diet
- Model competition from other salmon predators
- Assess effectiveness of regulations
- Conduct health assessment incorporating information on prey, contaminants, disease
- Evaluate coastal critical habitat

Outreach Partners



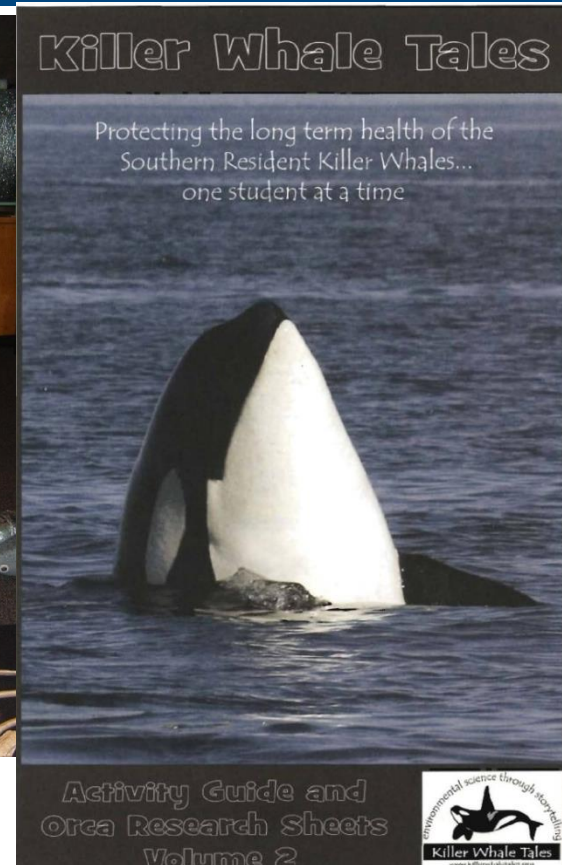
- OCNMS
- The Whale Trail
- Seattle Aquarium
- The Whale Museum
- Soundwatch
- Killer Whale Tales
- Sighting Networks
- Naturalists
- Whale Watch Assoc.
- NGOs



REPORT KILLER WHALE SIGHTINGS
Help us learn where the whales live in coastal waters

1-866-672-2638
A collaborative effort by: 1-866-ORCANET

the
CENTER for WHALE RESEARCH
www.whaleresearch.com
P.O. Box 1577
Friday Harbor, WA 98250
Northwest Fisheries Science Center
Dawn Noren@noaa.gov
www.nwfsc.noaa.gov/features/kwsightings.cfm

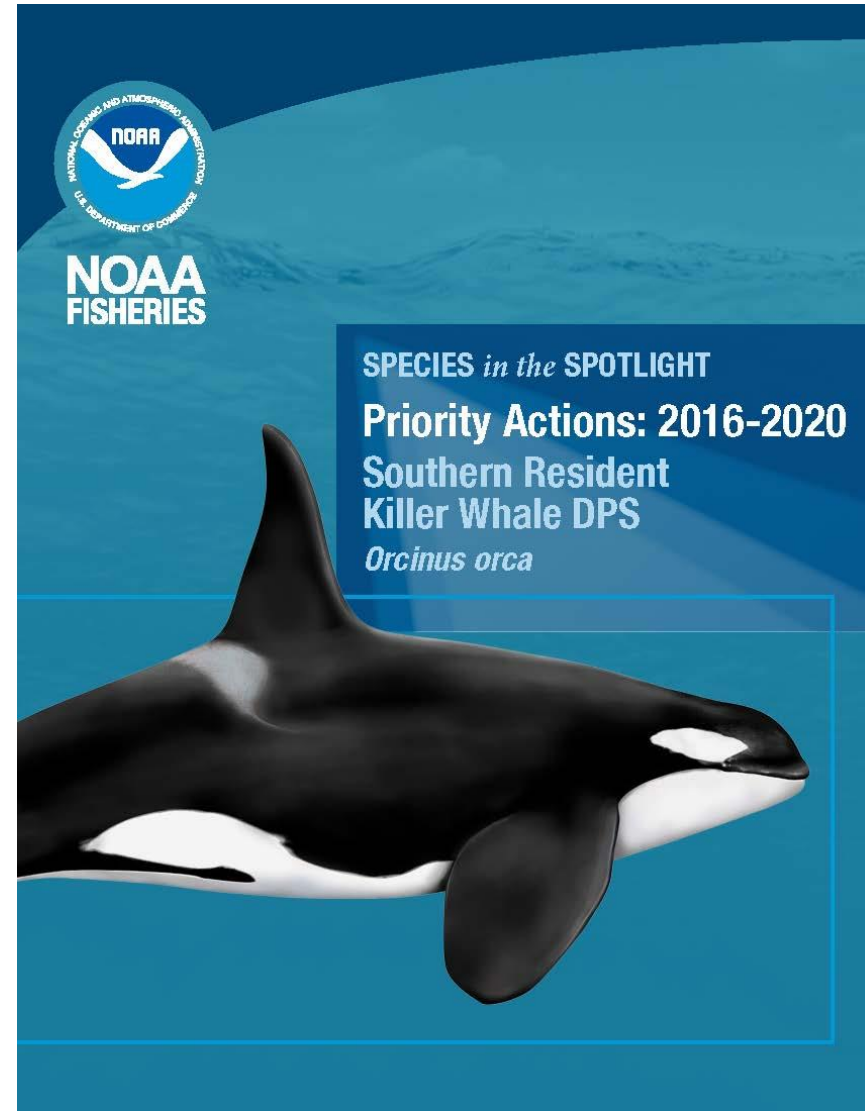


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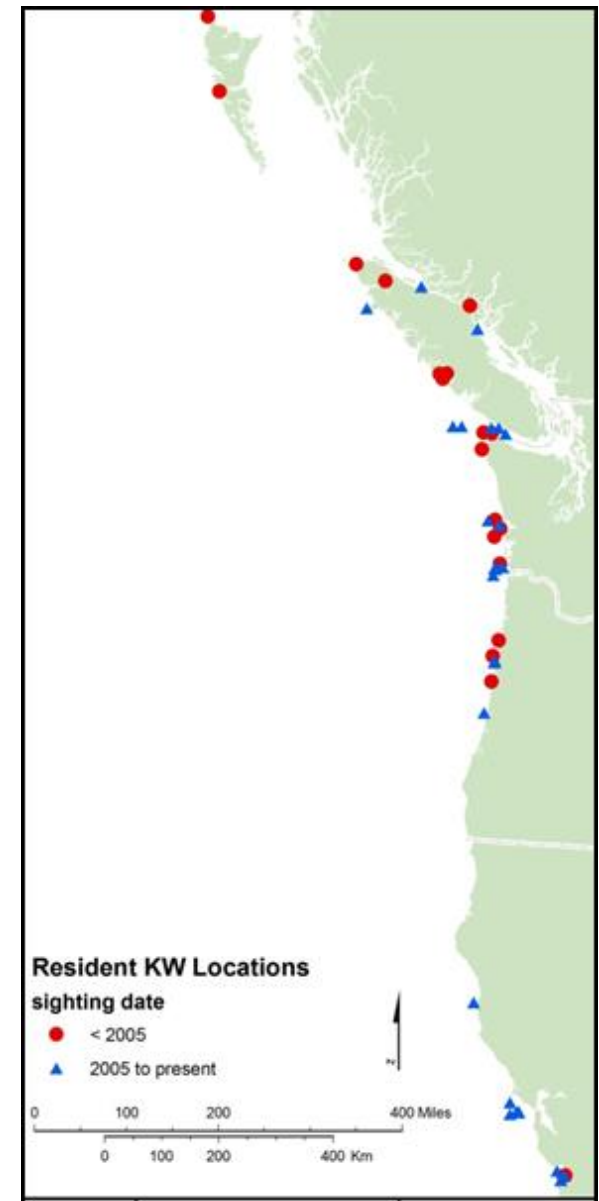
Species in the Spotlight

- Southern Resident killer whales one of eight at-risk species
- Action Plan identifies key actions and partners
 - Enforcement of vessel regulations
 - Target recovery of critical prey
 - Protect coastal habitats
 - Improve knowledge of health*
 - Education and outreach

http://www.nmfs.noaa.gov/stories/2015/05/05_14_15species_in_the_spotlight.html



Southern Resident Killer Whales and OCNMS

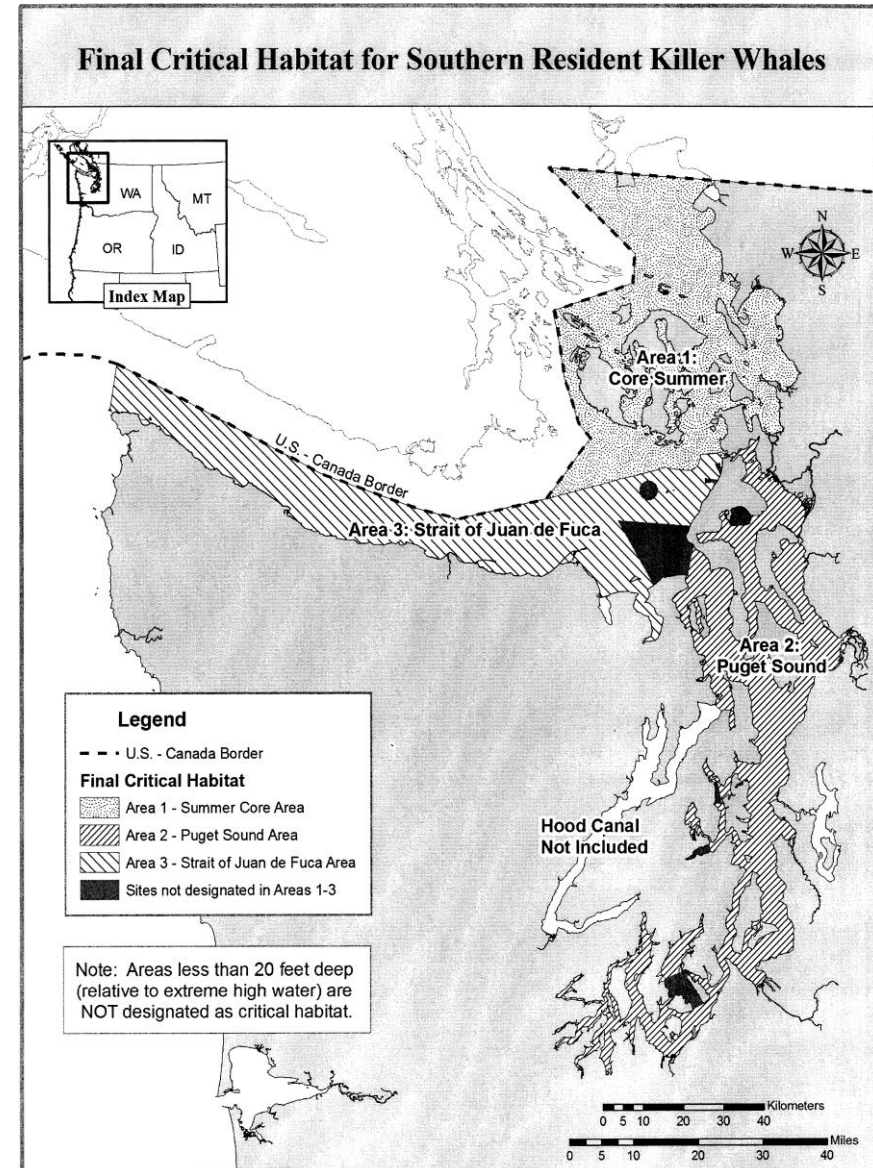


~35 coastal sightings since 1982

Critical habitat

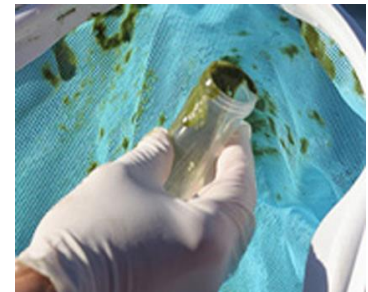
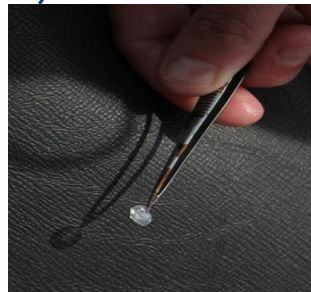
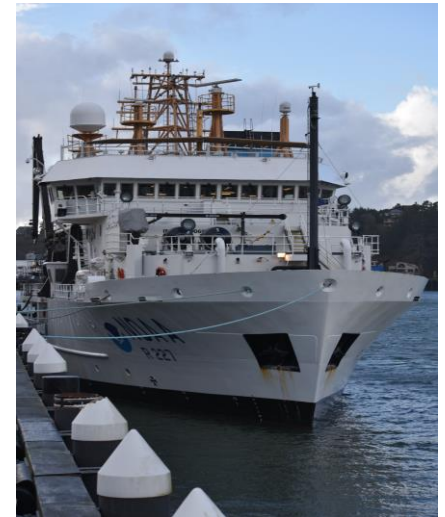
NMFS designated critical habitat
on November 26, 2006
(71 FR 69054)

- Approximately 2,560 square miles
- Primary constituent elements/essential features are:
 - (1) Water quality to support growth and development
 - (2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth
 - (3) Passage conditions to allow for migration, resting, and foraging.



Projects to improve our understanding of the range of SRKWs

- Satellite tagging of individuals
- Research cruises
- Acoustic monitoring along the coast
- Identification of prey species (stable isotopes, prey sampling, fecal sampling)
- Sightings



Revisions to critical habitat

- January 21, 2014: NMFS received a petition to revise critical habitat and consider coastal waters from Cape Flattery, WA to Point Reyes, CA and include protective in-water sound levels as a PCE in both current inland and possible coastal critical habitats.
- April 25, 2014: NMFS published its 90 day finding (79 FR 22933) that the petitioned action may be warranted and initiated a review and solicited scientific and commercial information pertaining to the action.
- February 24, 2015: NMFS published its 12 month finding (80 FR 9682) that we intend to proceed with the petitioned action and described how we plan to proceed, including ensuring that we have the best available information.



Next Steps

- *Step 1: Complete Data Collection and Analysis (ongoing)*
- *Step 2: Identify Areas Meeting the Definition of Critical Habitat (in process)*
- *Step 3: Section 4(b)(2) Analysis (upcoming)*
- *Step 4: Develop Proposed Rule for Public Comment (by fall 2017)*



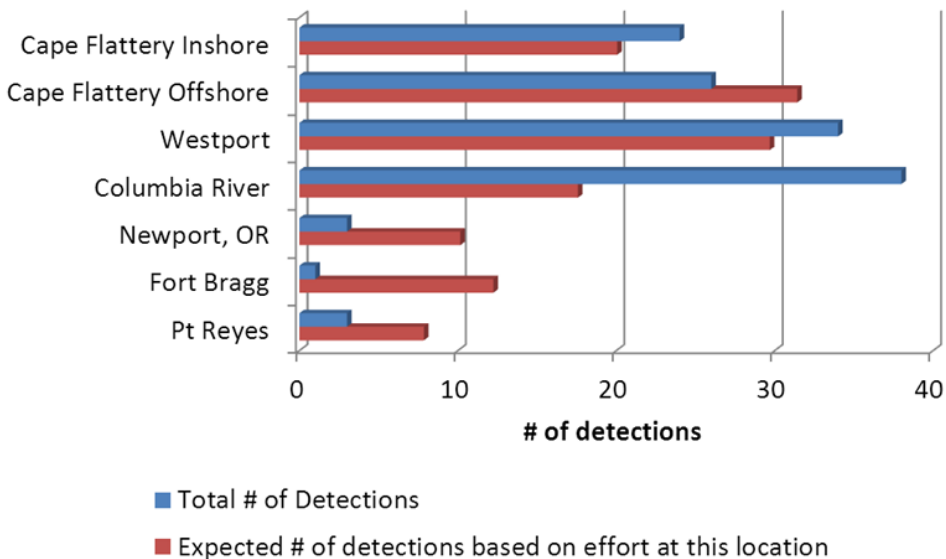
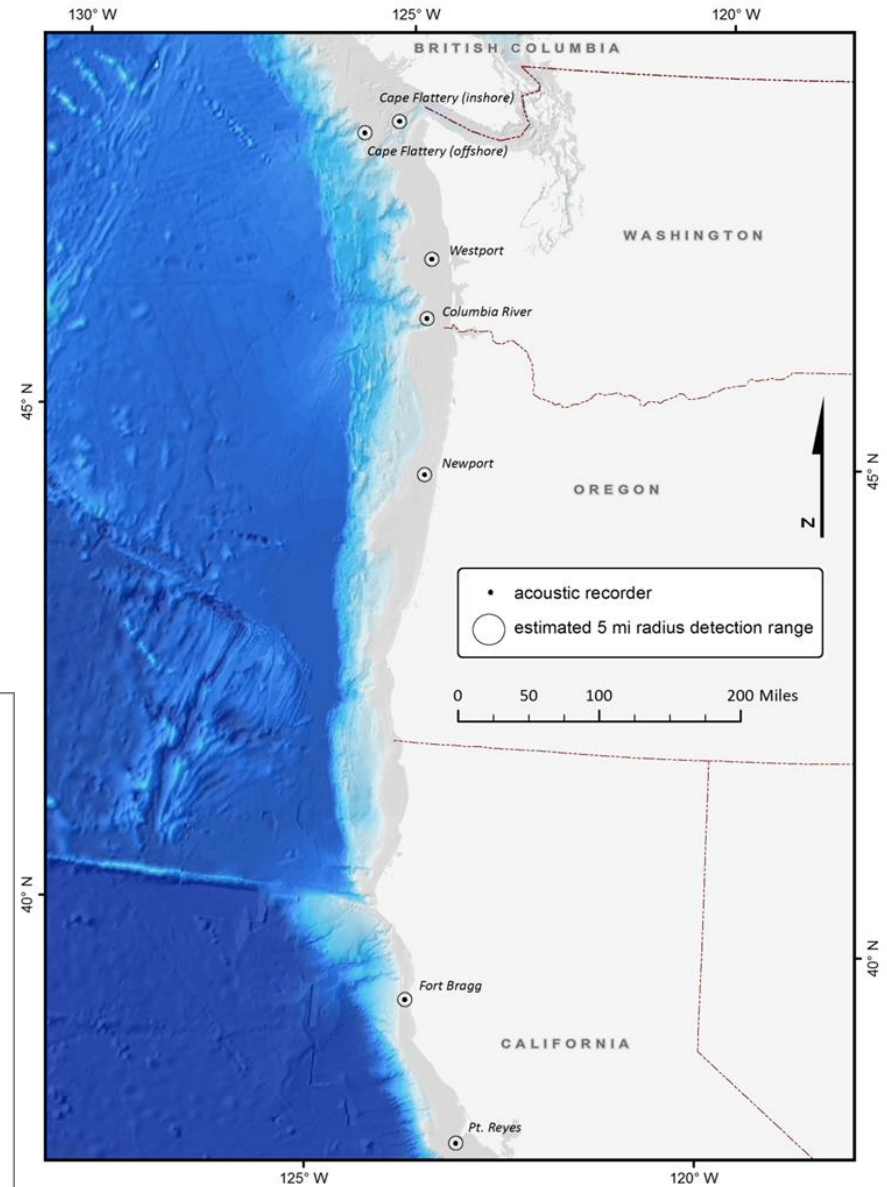
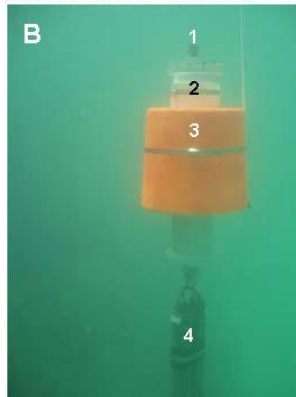
Passive Acoustic Recorders



Jeff Nystuen (APL) - PAL



Ecological Acoustic Recorder (EAR)



Satellite Tagging



Satellite Tagging

Eight adult males (J26, K25, L88, L87, J27, L84, K33, L95) tagged 2012-16

K25 tagged in Puget Sound

93-day transmission: 12/29/12 to 4/4/13

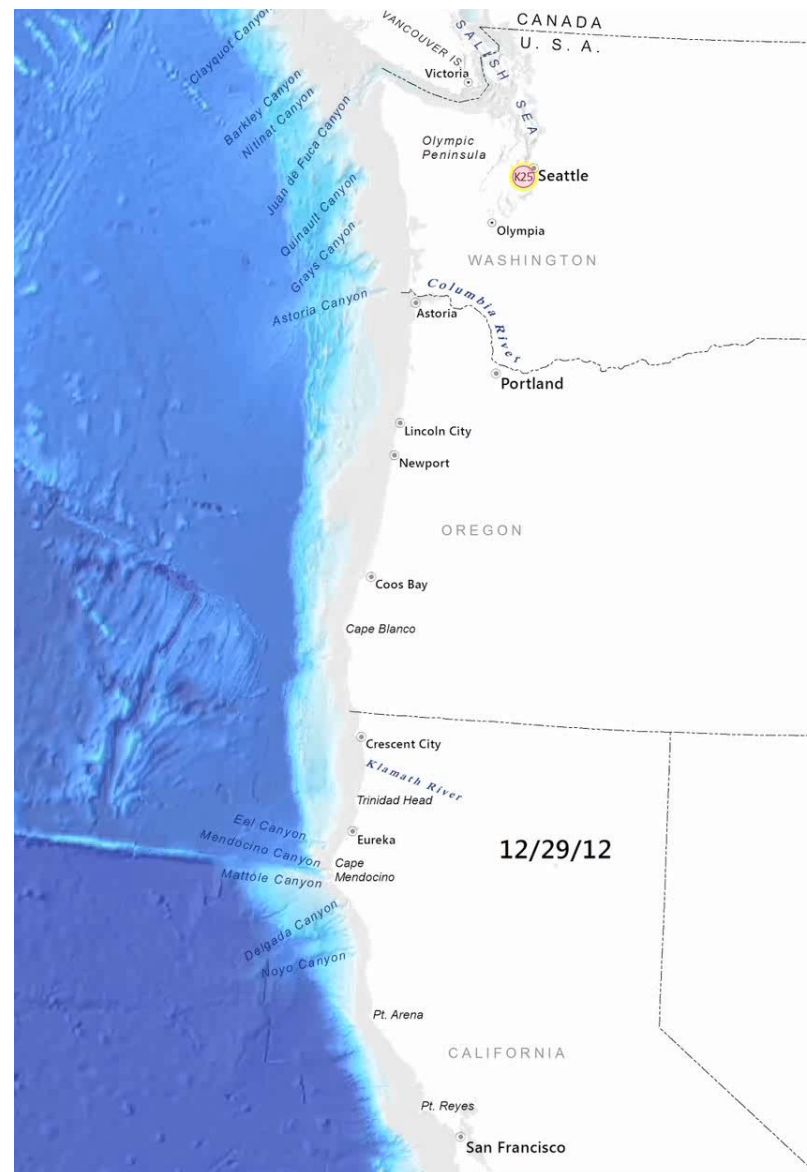
- Median distance from shore - 8.4 km

- Median depth – 60m

Coastal diet samples

California - 2 scale/tissue samples, 1 fecal sample

OR and WA - 23 scale/tissue samples, 21 fecal samples



Satellite Tagging and 2015 NOAA Cruise

Tag on J27 and L84 (96 days)

New calf sighted- L121

Coastal diet samples



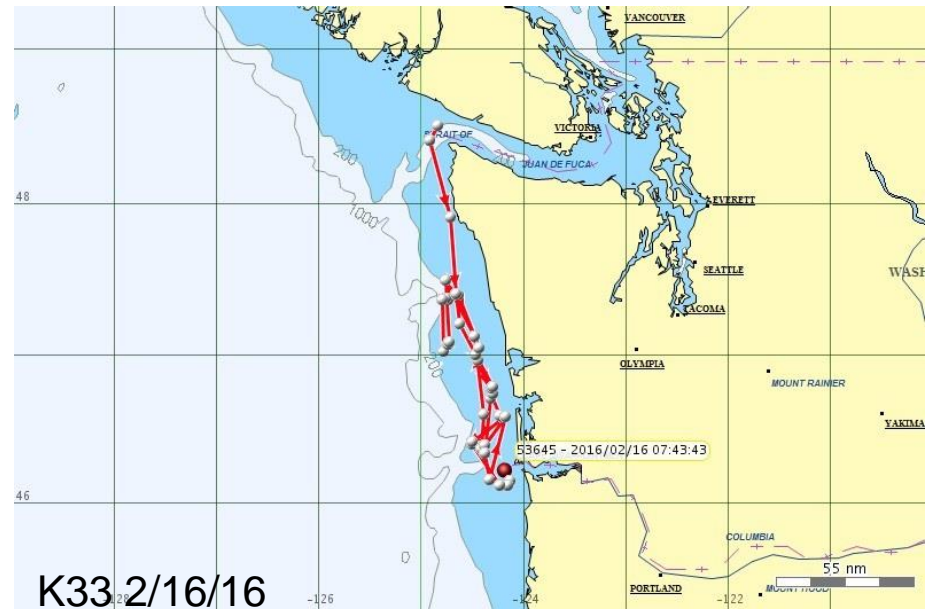
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Satellite Tagging and 2016 NOAA Cruise

Tags on K33 and L95
Coastal diet samples



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Sign up for "Orcalist" E-mail Listserve

http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/killer_whale/email_listserve.html